IN THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application. An identifier indicating the status of each claim is provided.

Listing of Claims

1.   (Currently Amended) A spread spectrum receiver receiving a spread spectrum signal spread in bandwidth by a predetermined spreading code, comprising[[;]]:

a local oscillator for outputting a local signal with a predetermined frequency,

a local spreading code generating means for generating a local spreading code according to the spreading code of the received signal, and

a direct conversion circuit for generating a reference local signal based on the local signal from the local oscillator and the local spreading code from the local spreading generating means, generating two signals having a phase difference based on the received signal and the reference local signal, and despreading based on two signals having a phase difference;

wherein the direct conversion circuit comprises:

a multiplier for multiplying the local signal by the local spreading code and outputting the same as the reference local signal,

a first phase shifter for shifting the received signal in phase,

a second phase shifter for shifting the reference local signal in phase,

a first adder for adding the reference local signal and an output signal of the first shifter,

a second adder for adding the received signal and an output signal of the second phase shifter,

a first detector for detecting a signal level of an output of the first adder, and

a second detector for detecting a signal level of an output of the second adder.

2.   (Canceled)

3.   (Currently Amended) A spread spectrum receiver as set forth in ~~claim 2~~ claim 1, wherein

the direct conversion circuit further comprises:

a first filter for performing a predetermined filtering processing with respect to an output

signal of the first detector and

a second filter for performing a predetermined filtering processing with respect to an

output signal of the second detector.

4.   (Currently Amended) A spread spectrum receiver as set forth in ~~claim 2~~ claim 1, wherein

the direct conversion circuit further comprises:

a third detector for detecting a signal level of the received signal.

5.   (Original) A spread spectrum receiver as set forth in claim 4, wherein

a first filter for performing a predetermined filtering processing with respect to an output

signal of the first detector,

a second filter for performing a predetermined filtering processing with respect to an

output signal of the second detector, and

a third filter for performing a predetermined filtering processing with respect to an output

signal of the third detector.

6.   (Original) A spread spectrum receiver as set forth in claim 1, wherein

the direct conversion circuit comprises:

a modulator for modulating the local signal by the local spreading code and outputting

the same as the reference local signal,

a first phase shifter for shifting the received signal in phase,

a second phase shifter for shifting the reference local signal in phase,

a first adder for adding the reference local signal and an output signal of the first shifter,

a second adder for adding the received signal and an output signal of the second phase

shifter,

a first detector for detecting a signal level Of an output of the first adder, and

a second detector for detecting a signal level of an output of the second adder.

7.   (Original) A spread spectrum receiver as set forth in claim 6, wherein

the direct conversion circuit further comprises:

a first filter for performing a predetermined filtering processing with respect to an output

signal of the first detector and

a second filter for performing a predetermined filtering processing with respect to an

output signal of the second detector.

8.   (Original) A spread spectrum receiver as set forth in claim 6, wherein

the direct conversion circuit further comprises:

a third detector for detecting a signal level of the received signal.

9.   (Original) A spread spectrum receiver as set forth in claim 8, wherein

the direct conversion circuit further comprises:

a first filter for performing a predetermined filtering processing with respect to an output

signal of the first detector,

a second filter for performing a predetermined filtering processing with respect to an

output signal of the second detector, and

a third filter for performing a predetermined filtering processing with respect to an output

signal of the third detector.

10.   (Original) A spread spectrum receiver as set forth in claim 6, wherein the modulator

comprises a quadrature modulator.

11.   (Original) A spread spectrum receiver as set forth in claim 1, wherein the spreading code

included in the reference Local signal is synchronized to the spreading code of the received

signal.

12.   (Original) A spread spectrum receiver as set forth in claim 1, wherein the carrier

frequency of the received signal is approximately equal to the carrier frequency of the reference

local signal.

13.   (Currently Amended) A spread spectrum receiver as set forth in ~~claim 2~~ claim 1, wherein

at least one of a first detector and second selector comprises a square-law detector.

14.   (Original) A spread spectrum receiver as set forth in claim 4, wherein at least one of the first, second, and third detectors comprises a square-law detector.

15.   (Original) A spread spectrum receiver as set forth in claim 6, wherein at least one of the first detector and second selector comprises a square-law detector.

16.   (Original) A spread spectrum receiver as set forth in claim 8, wherein at least one of the first, second, and third detectors comprises a square-law detector.

17.   (Currently Amended) A spread spectrum receiver receiving a spread spectrum signal spread in bandwidth by a predetermined spreading code, comprising:

a local oscillator for outputting a local signal with a predetermined frequency,

a local spreading code tracking means for generating a local spreading code through a process of synchronization and tracking based on the received signal and local signal from local oscillator, and

a direct conversion circuit for generating a reference local signal based on the local signal from the local oscillator and the local spreading code from the local spreading tracking means, generating two ~~signal~~ signals having a phase difference based on the received signal and the reference local signal, and despreading based on two signals having a phase difference;

wherein the local spreading code tracking means comprises:

a local spreading code generator for generating the local spreading code based on a value of a control signal,

a first phase adjusting means for delaying the generated local spreading code by a predetermined time,

a second phase adjusting means for advancing the generated local spreading code by a predetermined time,

a first multiplier for multiplying the local signal by an output of the first phase adjusting means,

a second multiplier for multiplying the local signal by an output of the second phase adjusting means,

a first adder for adding the received signal and an output of the first multiplier,

a first detector for detecting an amplitude component of an output signal of the first adder,

a first envelope detecting means for detecting a first envelope of an output signal of the first detector,

a second adder for adding the received signal and an output of the second multiplier,

a second detector for detecting an amplitude component of an output signal of the second adder,

a second envelope detecting means for detecting a second envelope of an output signal of the second detector, and

a control signal generating means for generating the control signal so as to reduce the difference between the first envelope and second envelope close to zero.

18.   (Canceled)

19.   (Original) A spread spectrum receiver as set forth in claim 17, wherein

the local spreading code tracking means comprises:

a local spreading code generator for generating the local spreading code based on a value

of a control signal,

a first phase adjusting means for delaying the generated local spreading code by a

predetermined time,

a second phase adjusting means for advancing the generated local spreading code by a

predetermined time,

a first multiplier for multiplying the local signal by an output of the first phase adjusting

means,

a second multiplier for multiplying the local signal by an output of the second phase

adjusting means,

a first phase shifter for shifting the received signal in phase,

a second phase shifter for shifting an output signal of the first multiplier in phase,

a third phase shifter for shifting an output signal of the second multiplier in phase,

a fourth phase shifter for shifting the received signal in phase,

a first adder for adding an output signal of the first phase shifter and the output of the first

multiplier,

a second adder for adding the received signal and an output signal of the second phase

shifter,

a third adder for adding the received signal and an output signal of the third phase shifter,

a fourth adder for adding the output signal of the second multiplier and an output signal

of the fourth phase shifter,

a first detector for detecting a signal level of an output of the first adder,

a second detector for detecting a signal level of an output of the second adder,

a third detector for detecting a signal level of an output of the third adder,

a fourth detector for detecting a signal level of an output of the fourth adder,

a first filter for performing a predetermined filtering processing with respect to an output

of a first detector,

a second filter for performing a predetermined filtering processing with respect to an

output of a second detector,

a third filter for performing a predetermined filtering processing with respect to an output

of a third detector,

a fourth filter for performing a predetermined filtering processing with respect to an

output of a fourth detector,

a first norm circuit for computing a first norm based on outputs of the first and second

filters,

a second norm circuit for computing a second norm based on outputs of the third and

fourth filters, and

a control signal generating means for generating the control signal so as to reduce the

difference between the first norm and second norm close to zero.

20. (Original) A spread spectrum receiver as set fourth in claim 19, wherein at least one of

the first, second, third, and fourth detectors comprises a square-law detector.

21.   (Original) A spread spectrum receiver as set fourth in claim 19, wherein the spreading

code tracking means further comprises:

a means for removing D.C. offset from outputs of the first, second, third, and fourth filter.

22.   (Original) A spread spectrum receiver as set forth in claim 17, wherein

the local spreading code tracking means comprises:

a first local spreading code generator for generating an in-phase local spreading code

based on a value of a control signal,

a second local spreading code generator for generating a quadration local spreading code

based on the value of a control signal,

a first phase adjusting means for delaying the generated in-phase and quadration local

spreading codes by a predetermined time,

a second phase adjusting means for advancing the generated i.,,-phase and quadratic,

local spreading codes by a predetermined time,

a first quadrature modulator for modulating the local signal by output signals of the first

phase adjusting means,

a second quadrature modulator for modulating the local signal by output signals of the

second phase adjusting means,

a first phase shifter for shifting the received signal in phase,

a second phase shifter for shifting an output signal of the first quadrature modulator in

phase,

a third phase shifter for shifting an output signal of the second quadrature modulator in

phase,

a fourth phase shifter for shifting the received signal in phase,

a first adder for adding an output signal of the first phase shifter and the output of the first quadrature modulator,

a second adder for adding the received signal and an output signal of the second phase shifter,

a third adder for adding the received signal and an output signal of the third phase shifter,

a fourth adder for adding the output signal of the second quadrature modulator and an output signal of the fourth phase shifter,

a first detector for detecting a signal level of an output of the first adder,

a second detector for detecting a signal level of an output of the second adder,

a third detector for detecting a signal level of an output of the third adder,

a fourth detector for detecting a signal level of an output of the fourth adder,

a first filter for performing a predetermined filtering processing with respect to an output of a first detector,

a second filter for performing a predetermined filtering processing with respect to an output of a second detector,

a third filter for performing a predetermined filtering processing with respect to an output of a third detector,

a fourth filter for performing a predetermined filtering processing with respect to an output of a fourth detector,

a first norm circuit for computing a first norm based on outputs of the first and second filters,

a second norm circuit for computing a second norm based on outputs of the third and fourth filters, and

a control signal generating means for generating the control signal so as to reduce the difference between the first norm and second norm close to zero.

23.   (Original) A spread spectrum receiver as set fourth in claim 22, wherein at least one of the first, second, third, and fourth detectors comprises a square-law detector.

24.   (Original) A spread spectrum receiver as set fourth in claim 22, wherein the spreading code tracking means further comprises:

a means for removing D.C. offset from outputs of the first, second, third, and fourth filters.

25.   (Original) A spread spectrum receiver as set forth in claim 17, wherein

the local spreading code tracking means comprises:

a first local spreading code generator for generating an in-phase local spreading code based on a value of a control signal,

a second local spreading code generator for generating a quadration local spreading code based on the value of a control signal,

a first phase adjusting means for delaying the generated in-phase local spreading code by a predetermined time,

a second phase adjusting means for delaying the generated quadration local spreading code by a predetermined time,

a third phase adjusting means for advancing the generated in-phase local spreading code by a predetermined time,

a fourth phase adjusting means for advancing the generated quadration local spreading code by a predetermined time,

a first multiplier for multiplying the local signal by an output signal of the first phase adjusting means,

a second multiplier for multiplying the local signal by an output signal of the second phase adjusting means,

a third multiplier for multiplying the local signal by an output signal of the third phase adjusting means,

a fourth multiplier for multiplying the local signal by an output signal of the fourth phase adjusting means,

a first adder for adding the received signal and an output signal of the first multiplier,

a second adder for adding the received signal and an output signal of the second multiplier,

a third adder for adding the received signal and an output signal of the third multiplier,

a fourth adder for adding the received signal and an output signal of the fourth multiplier,

a first detector for detecting a signal level of an output of the first adder,

a second detector for detecting a signal level of an output of the second adder,

a third detector for detecting a signal level of an output of the third adder,

a fourth detector for detecting a signal level of an output of the fourth adder,

a first filter for performing a predetermined filtering processing with respect to an output of a first detector,

a second filter for performing a predetermined filtering processing with respect to an output of a second detector,

a third filter for performing a predetermined filtering processing with respect to an output of a third detector,

a fourth filter for performing a predetermined filtering processing with respect to an output of a fourth detector,

a first norm circuit for computing a first norm based on outputs of the first and second filters,

a second norm circuit for computing a second norm based on outputs of the third and fourth filters, and

a control signal generating means for generating the control signal so as to reduce the difference between the first norm and second norm close to zero.

26.   (Original) A spread spectrum receiver as set fourth in claim 25, wherein at least one of the first, second, third, and fourth detectors comprises a square-law detector.

27.   (Original) A spread spectrum receiver as set fourth in claim 25, wherein the spreading code tracking means further comprises:

a mean for removing D.C. offset from outputs of the first, second, third, and fourth filters.

28.   (Currently Amended) A spread spectrum receiver as set forth in ~~claim 18~~ claim 17,

wherein the direct conversion circuit comprises:

a multiplier for multiplying the local signal by the local spreading code and outputting the

sane as the reference local signal,

a first phase shifter for shifting the received signal in phase,

a second phase shifter for shifting the reference local signal in phase,

a first adder for adding the reference local signal and an output signal of the first shifter,

a second adder for adding the received signal and an output signal of the second phase

shifter,

a first detector for detecting a signal level of an output of the first adder, and

a second detector for detecting a signal level of an output of the second adder.

29.   (Original) A spread spectrum receiver as set forth in claim 28, wherein

the direct conversion circuit further comprises:

a first filter for performing a predetermined filtering processing with respect to an output

signal of the first detector, and

a second filter for performing a predetermined filtering processing with respect to an

output signal of the second detector.

30.   (Original) A spread spectrum receiver as set forth in claim 28, wherein

the direct conversion circuit further comprises:

a third detector for detecting a signal level of the received signal.

31.   (Original) A spread spectrum receiver as set forth in claim 30, wherein

the direct conversion circuit further comprises:

a first filter for performing a predetermined filtering processing with respect to an output

signal of the first detector,

a second filter for performing a predetermined filtering processing with respect to an

output signal of the second detector, and

a third filter for performing a predetermined filtering processing with respect to an output

signal of the third detector.

32.   (Original) A spread spectrum receiver as set forth in claim 19, wherein

the direct conversion circuit comprises:

a quadrature modulator for modulating the local signal by the in-phase and quadration

local spreading codes and outputting the same as the reference local signal,

a first phase shifter for shifting the received signal in phase,

a second phase shifter for shifting the reference local signal in phase,

a first adder for adding the reference local signal and an output signal of the first shifter,

a second adder for adding the received signal and an output signal of the second phase

shifter,

a first detector for detecting a signal level Of an output of the first adder, and

a second detector for detecting a signal level of an output of the second adder.

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33.   (Original) A spread spectrum receiver as set forth in claim 32, wherein

the direct conversion circuit further comprises:

a first filter for performing a predetermined filtering processing with respect to an output

signal of the first detector and

a second filter for performing a predetermined filtering processing with respect to an

output signal of the second detector.

34.   (Original) A spread spectrum receiver as set forth in claim 32, wherein

the direct conversion circuit further comprises:

a third detector for detecting a signal level of the received signal.

35.   (Original) A spread spectrum receiver as set forth in claim 34, wherein

the direct conversion circuit further comprises:

a first filter for performing a predetermined filtering processing with respect to an output

signal of the first detector,

a second filter for performing a predetermined filtering processing with respect to an

output signal of the second detector, and

a third filter for performing a predetermined filtering processing with respect to an

output: signal of the third detector.

36.   (Original) A spread spectrum receiver as set forth in claim 17, wherein the spreading

code included in the reference local signal is synchronized to the spreading code of the received

signal.

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37.   (Original) A spread spectrum receiver as set forth in claim 17, wherein the carrier

frequency of the received signal is approximately equal to the carrier frequency of the reference

local signal.

38.   (Currently Amended) A spread spectrum receiver for software radio receiving a spread

spectrum signal spread in bandwidth by a predetermined spreading code, comprising[[;]]:

    a local oscillator for outputting a local signal with a predetermined frequency,

    a local spreading code tracking means for generating a local spreading code through a

process, including digital processing, of synchronization and tracking based on the received

signal and the local signal from the local oscillator, and

    a direct conversion circuit for generating a reference local signal based on the local signal

from the local oscillator and the local spreading code from the local spreading tracking means,

generating two signals having a phase difference based on the received signal and the reference

local signal, and despreading based on the two signals having a phase difference;

    wherein the local spreading code tracking means comprises:

    a first local spreading code generator for generating an in-phase local spreading code

based on a value of a control signal,

    a second local spreading code generator for generating a quadration local spreading code

based on the value of a control signal,

    a first phase adjusting means for delaying the generated in-phase and quadration local

spreading codes by a predetermined time,

a second phase adjusting means for advancing the generated in-phase and quadration local spreading codes by a predetermined time,

a first quadrature modulator for modulating the local signal by an output signals of the first phase adjusting means,

a second quadrature modulator for modulating the local signal by an output signal of the second phase adjusting means,

a first phase shifter for shifting the received signal in phase,

a second phase shifter for shifting an output signal of the first quadrature modulator :in phase,

a third phase shifter for shifting an output signal of the second quadrature modulator in phase,

a fourth phase shifter for shifting the received signal in phase,

a first adder for adding an output signal of the first phase shifter and the output of the first quadrature modulator,

a second adder for adding the received signal and an output signal of the second phase shifter,

a third adder for adding the received signal and an output signal of the third phase shifter,

a fourth adder for adding the output signal of the second quadrature modulator and an output signal of the fourth phase shifter,

a first detector for detecting a signal level of an output of the first adder,

a second detector for detecting a signal level of an output of the second adder,

a third detector for detecting a signal level of an output of the third adder,

a fourth detector for detecting a signal level of an output of the fourth adder,

a first filter for performing a predetermined filtering processing with respect to an output

of a first detector,

a second filter for performing a predetermined filtering processing with respect to an

output of a second detector,

a third filter for performing a predetermined filtering processing with respect to an output

of a third detector,

a fourth filter for performing a predetermined filtering processing with respect to an

output of a fourth detector,

a first analog to digital (A/D) converting means for converting output analog signals of

the first and second filters to digital signals,

a second A/D converting means for converting outputs analog signals of the third and

fourth filters to digital signals, and

a digital processing means for generating the control signal so as to reduce the difference

between the outputs of the first A/D converting means and second A/D converting means close

to zero.

39.   (Canceled)

40.   (Currently Amended) A spread spectrum receiver as set ~~fourth~~ forth in ~~claim 39~~ claim 38,

wherein at least one of the first, second, third, and fourth detectors comprises a square-law

detector.